Ultrafine Particle (UFP) Number Concentrations during the Harbor Communities Monitoring Study

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Overview/Motivation

USC UFP network

- 13 sites
- San Pedro/Wilmington and West Long Beach clusters, downtown LA
- Continuous observations
  - Total particle number concentration data (UFP ≈ 85 - 90%)
    - Some particle size distribution data
  - meteorology
- mid-February - mid-December 2007

Goal: quantify Intra-Community variability

- UFP and adverse health impacts
  - Exposure assessments
- Variety of scales
  - Temporal (daily, weekly, monthly, seasonal)
  - Spatial (background vs. impacted sites)

Key Points

UFP concentrations vary with

- **Proximity to sources**
  - I-710 vs. PoLA's Berth 47
- **Source emission patterns**
- **"Goods movement" profile**
  - Step function
  - Heavy-duty diesel emissions
- **Meteorology**
  - Summer vs. fall concentrations
  - Changes in wind speed/direction (e.g. Santa Anas)
- **Daily, weekly, monthly, seasonal differences**

Based upon hourly average data by month

UFP intra-community is similar to inter-community variability

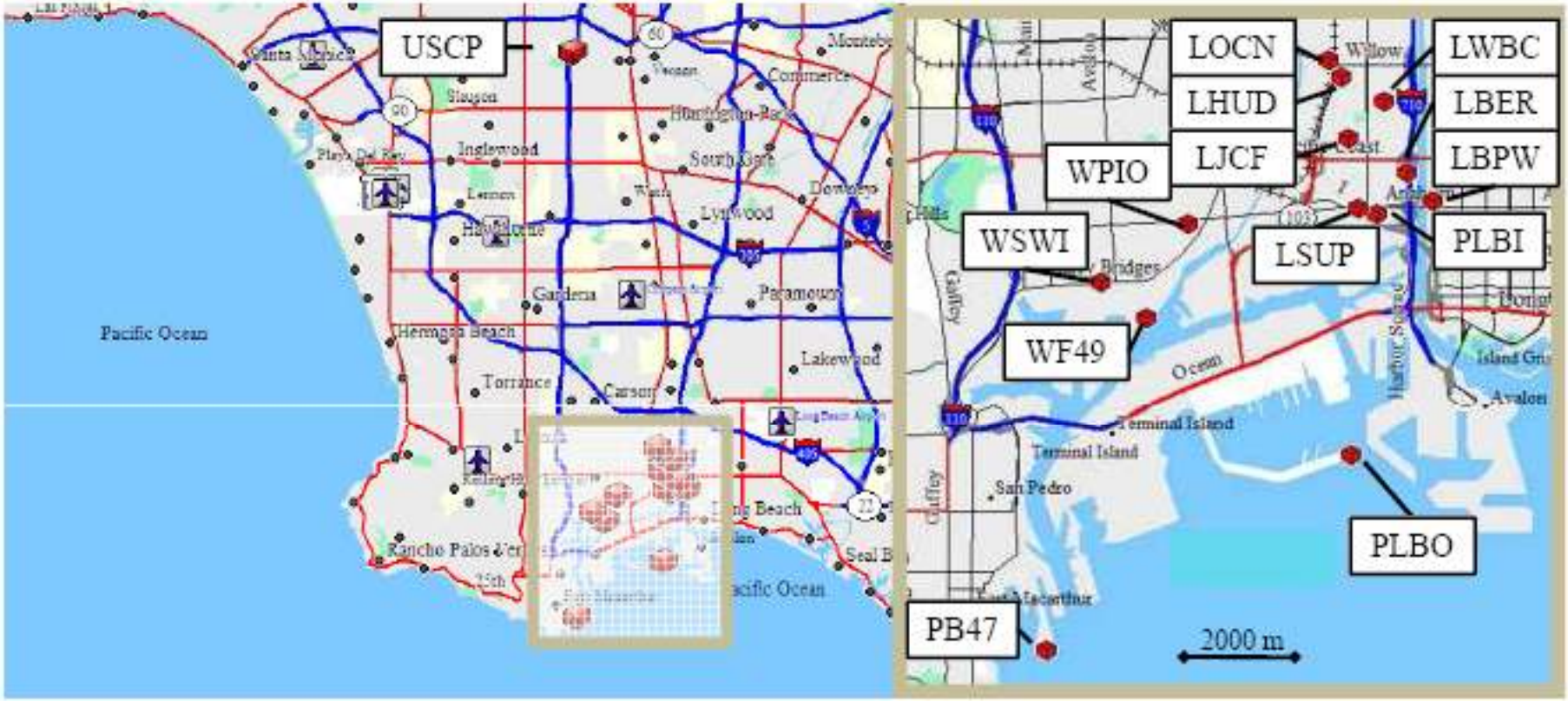
- Comparison Children's Health Study results

Quantify UFP intra-community spatial variability

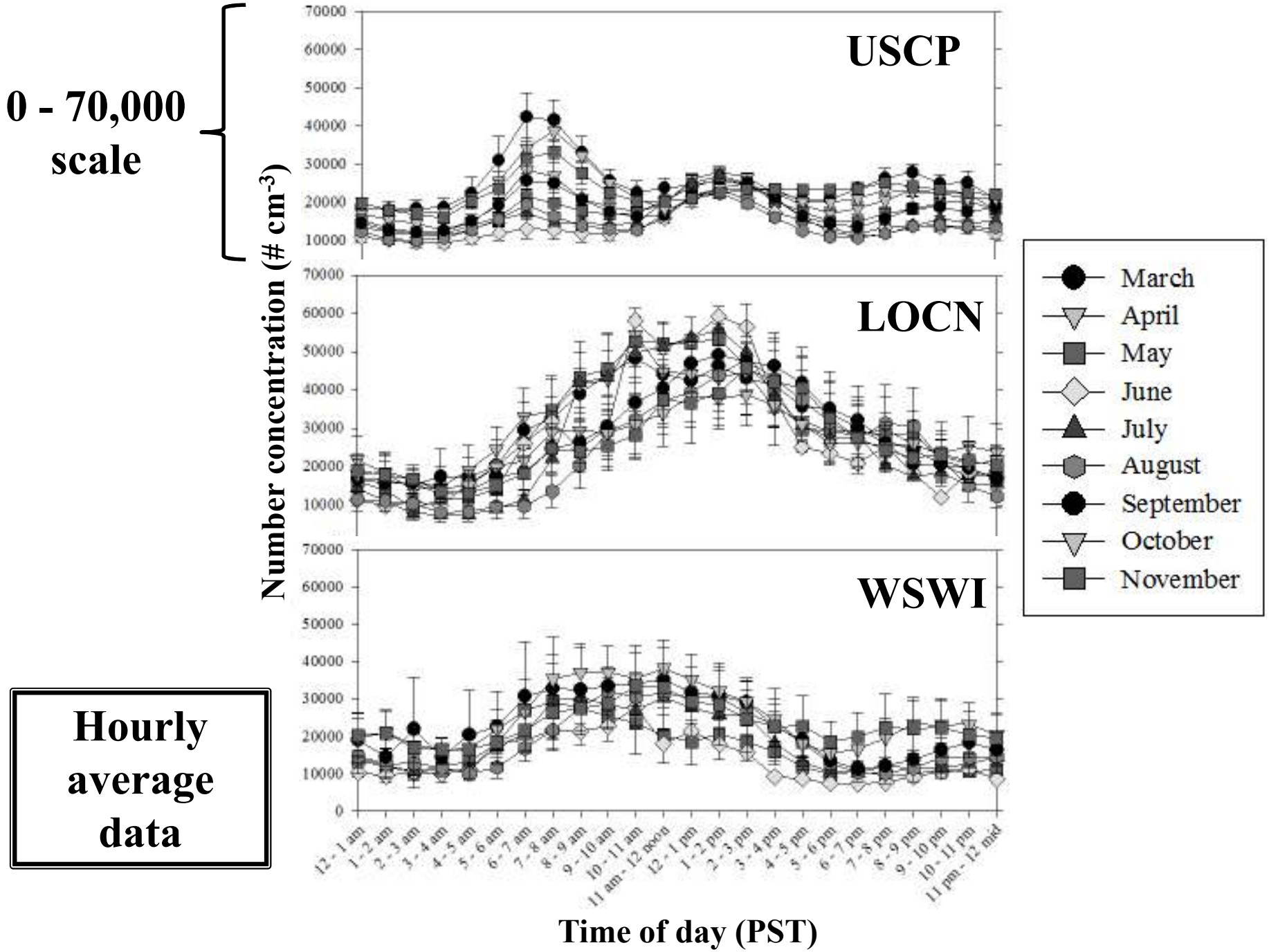
- Coefficients of Divergence
- **"moderately heterogeneous"**

Condensation Particle Counter (3022A)

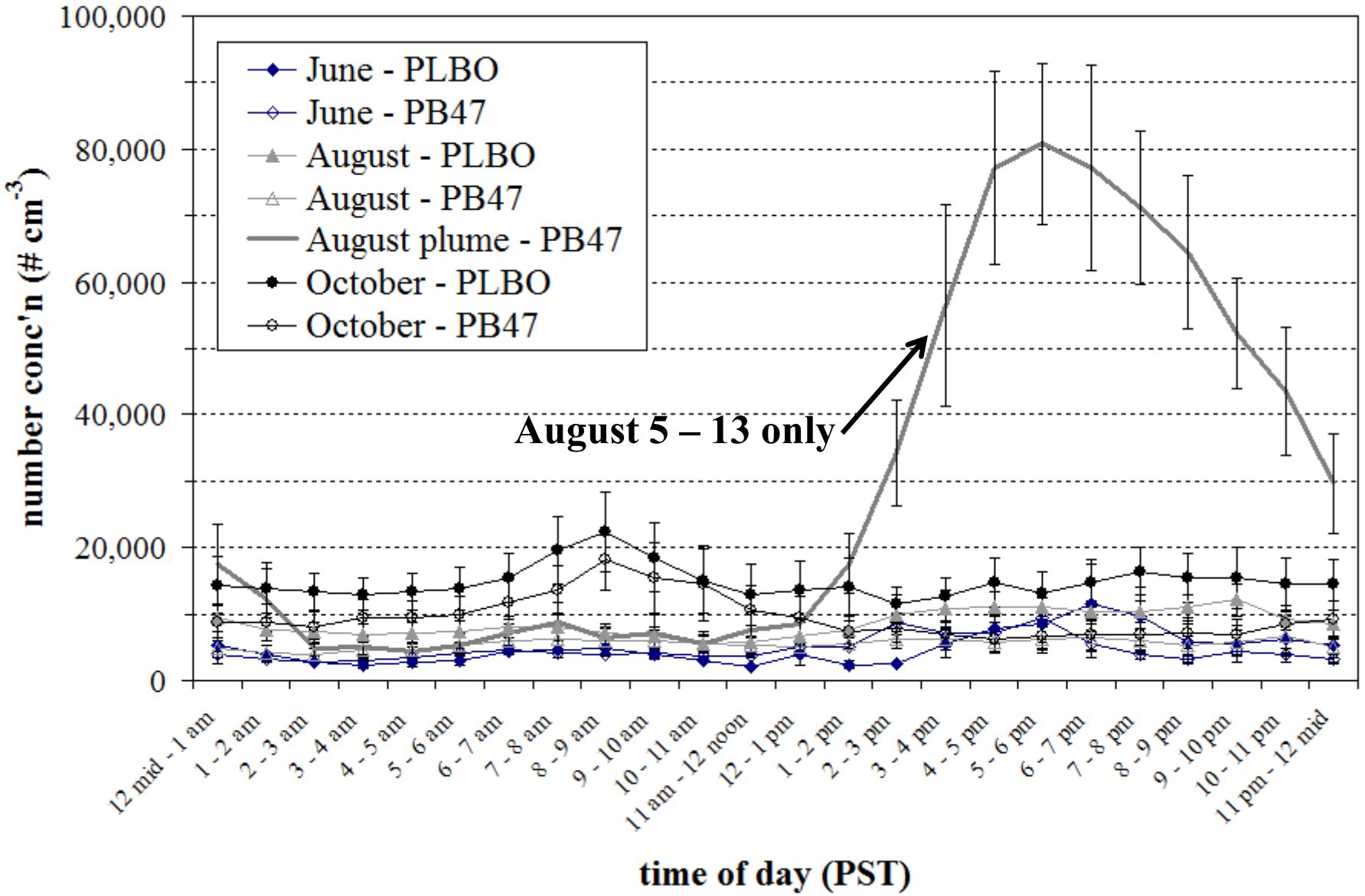
USC Network



- prevailing winds
  - "sea breeze" (overnight calms)
  - PM westerlies in WLB


0 - 70,000 scale
Number concentration (# cm-3)
USCP
LOCN
WSWI
70000
60000
50000
40000
30000
20000
10000
0
March
April
May
June
July
August
September
October
November
12 - 1 am
1 - 2 am
2 - 3 am
3 - 4 am
4 - 5 am
5 - 6 am
6 - 7 am
7 - 8 am
8 - 9 am
9 - 10 am
10 - 11 am
11 am - 12 noon
12 - 1 pm
1 - 2 pm
2 - 3 pm
3 - 4 pm
4 - 5 pm
5 - 6 pm
6 - 7 pm
7 - 8 pm
8 - 9 pm
9 - 10 pm
10 - 11 pm
11 pm - 12 mid
Time of day (PST)
Hourly average data

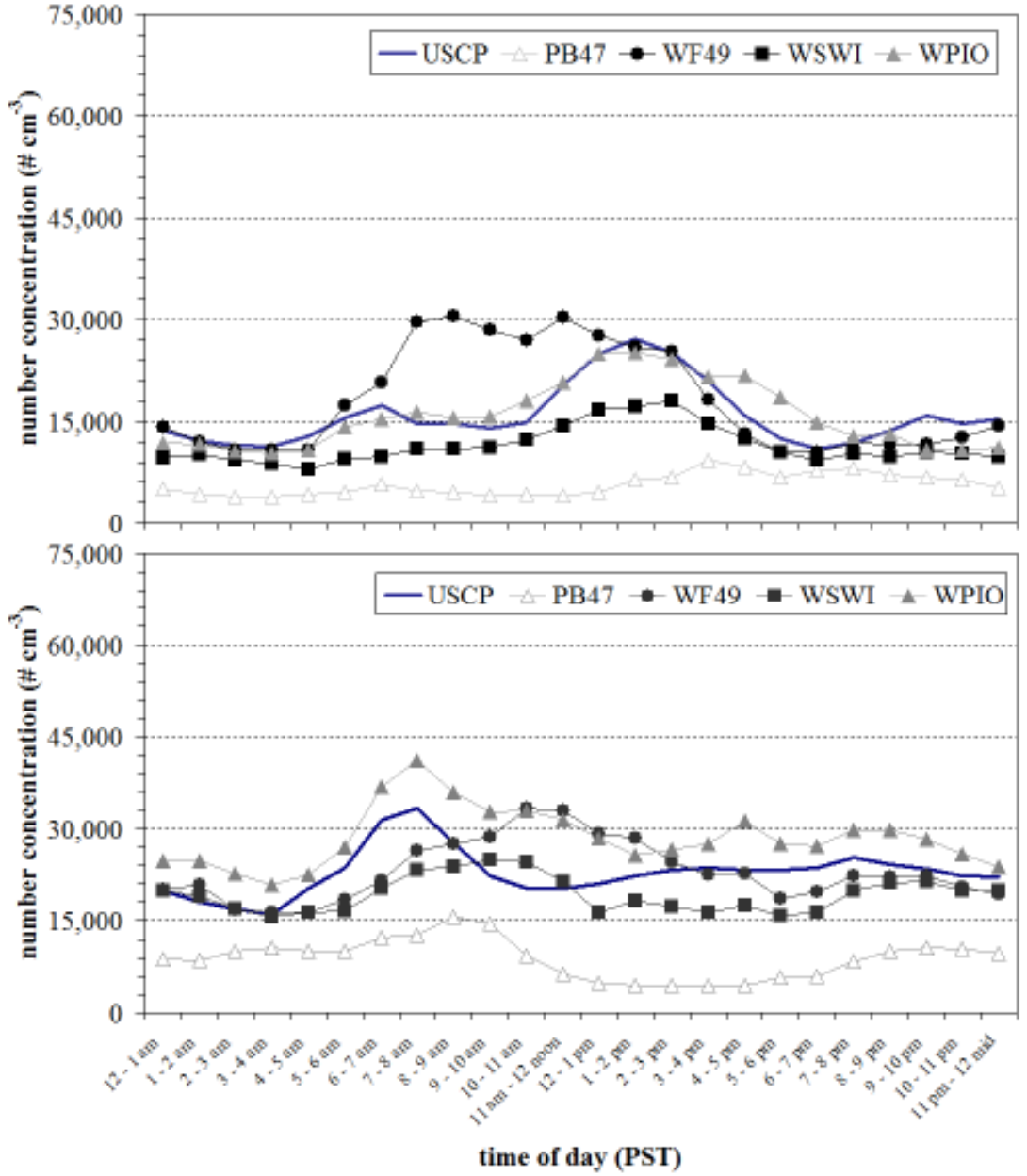
Background sites: PLBO & PB47



San Pedro/ Wilmington cluster

July

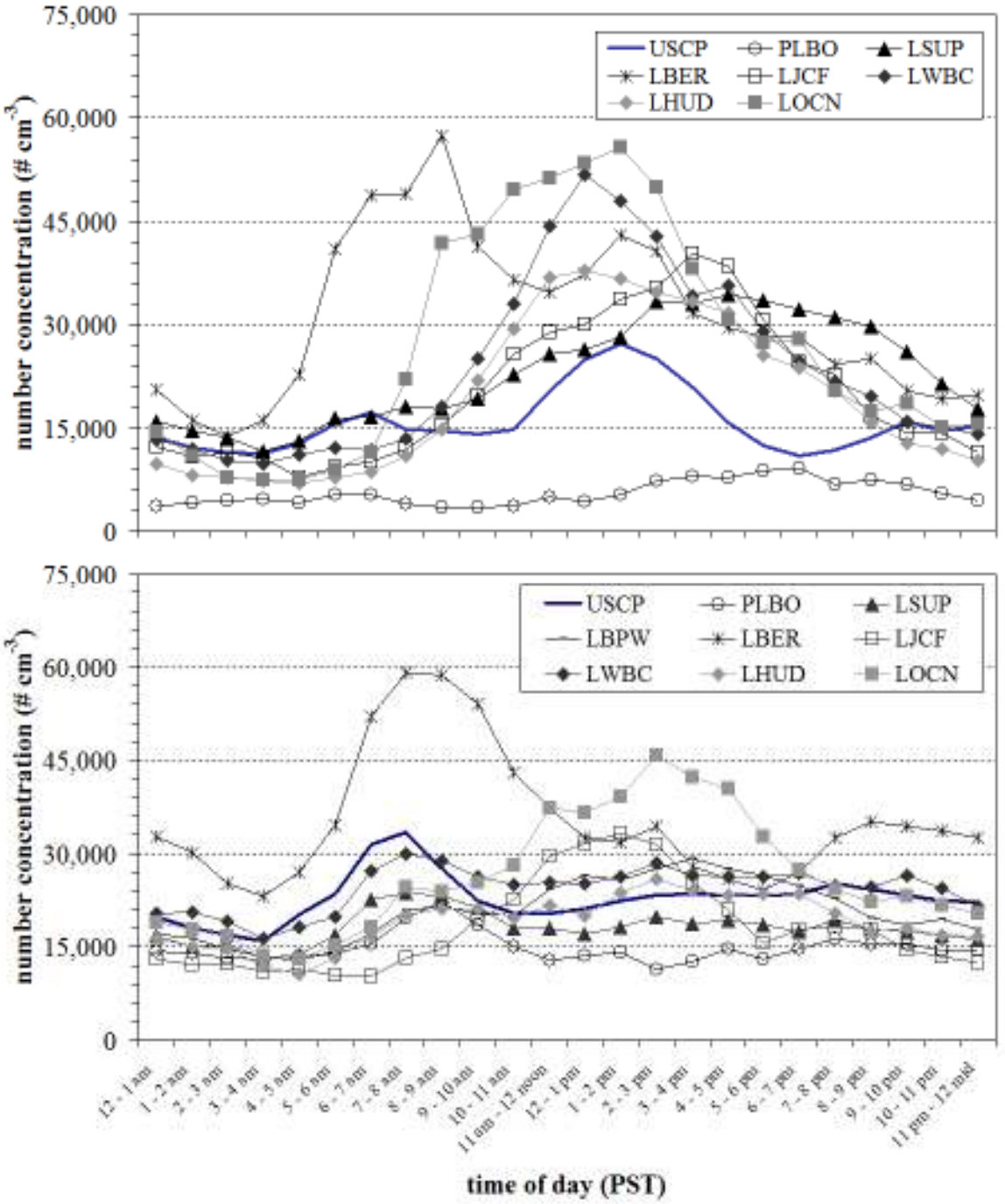
November



West Long Beach cluster

July

November



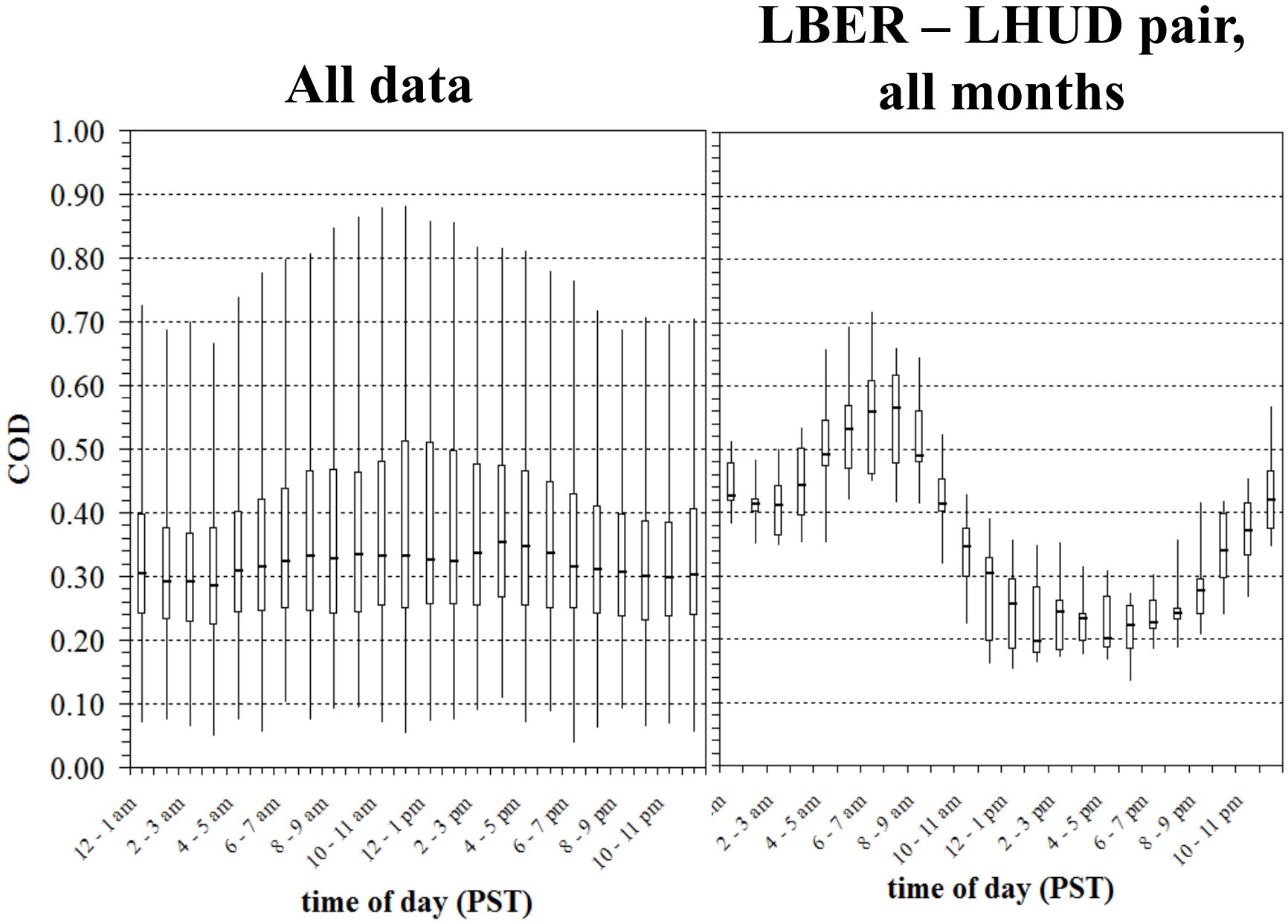
Coefficients of Divergence (CODs)

- Measure of homogeneity between sites
  - COD = 0 → homogeneous data
  - COD = 1 → heterogeneous data

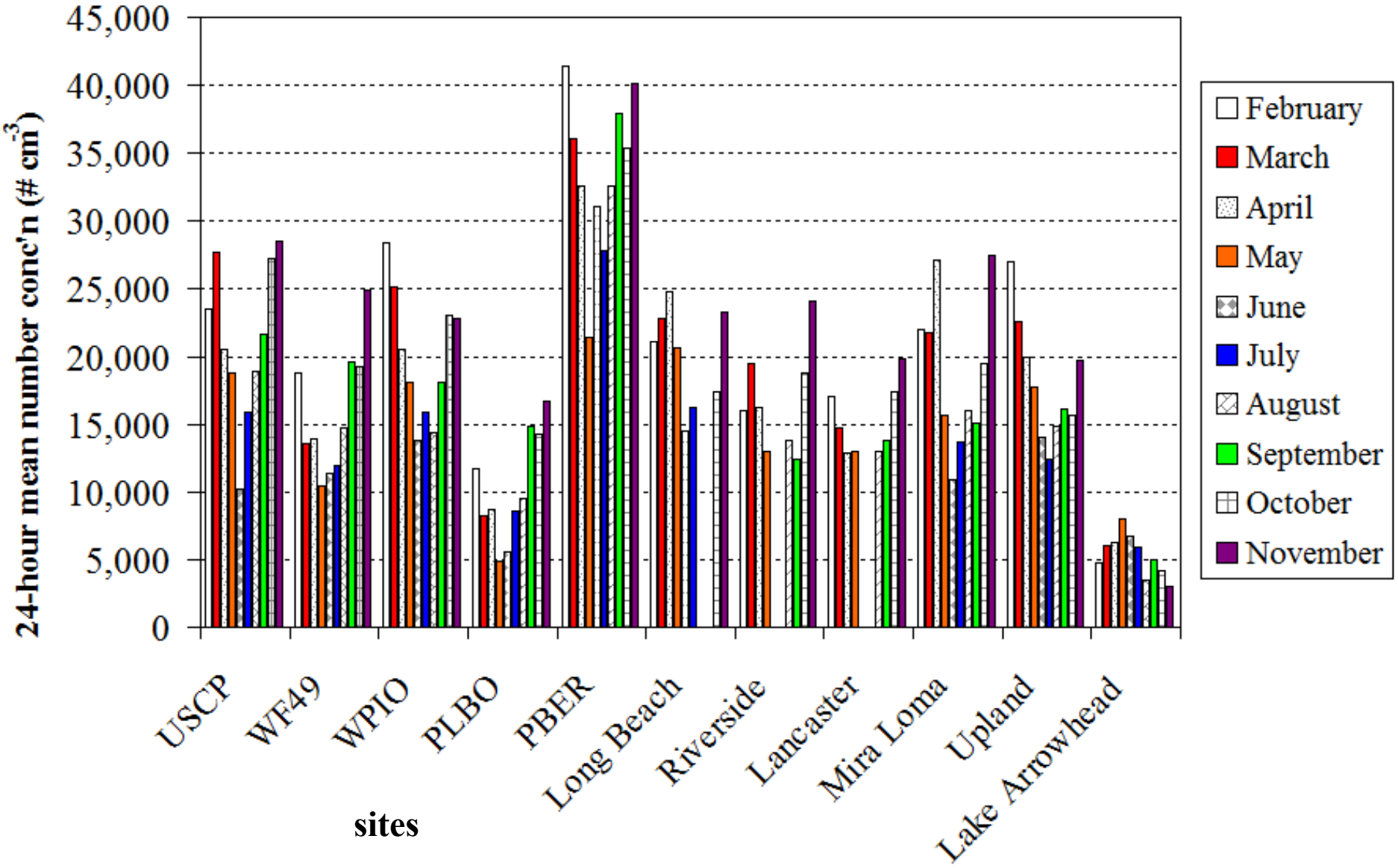
$$COD_{jk} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left[\frac{\left(x_{ij} - x_{ik}\right)}{\left(x_{ij} + x_{ik}\right)}\right]^2}$$

n = # of values (concentrations, x) for paired sites j and k

CODs


All data
LBER – LHUD pair, all months
COD
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
12 - 1 am
2 - 3 am
4 - 5 am
6 - 7 am
8 - 9 am
10 - 11 am
12 - 1 pm
2 - 3 pm
4 - 5 pm
6 - 7 pm
8 - 9 pm
10 - 11 pm
time of day (PST)
time of day (PST)

24-hour mean & CHS sites



Summary

- UFP **variability** on many **spatial** and **temporal** scales
- **Goods movement profile**
- Moderately **heterogeneous** concentrations overall but broad range observed (COD results)
- Two manuscripts submitted

On-going analyses

- Modeling (Professor R. Henry/USC)
- Case studies at **higher temporal resolution**
- Combine **size distribution, meteorology** and **UFP number concentration** data
- UFP and additional HCMS measurements (e.g. CO, NO/NO_2, solar radiation …)

Acknowledgments

- **California Air Resources Board**
- **South Coast Air Quality Management District**
- **Ports of Los Angeles and Long Beach**
- **HCMS colleagues (DRI and UCLA/ARB)**
- **Members of the Harbor Communities**

  - The Berns Company
  - D. Berns
  - D. Seymour
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